Use Of QPE Flash Flood Forecasting: Some Experiences On The Cuareim River

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Introduction

A long-standing problem of great interest among the meteorological and hydrological communities has been how to represent the spatial distribution of precipitation at small scales in regions without radar coverage and with only a sparse rain gauge network. In this case, satellite-derived quantitative precipitation estimates (QPE) are an extremely powerful tool for obtaining rainfall patterns that can be used by distributed hydrologic models to produce forecasts of discharge. The main purpose of this presentation is to evaluate the performance of the National Oceanic and Atmospheric Administration / National Environmental Satellite, Data, and Information Service (NOAA/NESDIS) Hydro-Estimator (H-E) satellite rainfall estimation technique over the Cuareim basin.

Data And Methodology

One and a half year of 24-hour H-E retrievals obtained from NOAA/NESDIS (March 2002-July 2003) over the Cuareim subcatchment were used in this study. Data from approximately 30 rain gauges over the target area from the Salto Grande Mixed Technical Commission (CTMSG) and the National Meteorology Direction (DNM) of Uruguay, were used for validation purposes.
The main features of the algorithm applied in this paper are as follows:

- Rain rate estimation: fully automated method using an empirical power-law function that generates rainfall rates (mm/h) based on GOES-8 channel 4 brightness temperature (Vicente et al, 1998). Two types of precipitation are defined: 'core' precipitation: computed essentially by the empirical power-law function; and 'non core' precipitation: whose maximum value cannot exceed 12mmh-1 and must be less than the fifth part of the convective rainfall for a given pixel. For more details; see Vila (2003)
- Moisture correction: a moisture correction was developed by applying the precipitable water (PW) and relative humidity (RH) corrections obtained from NWP models. The precipitable water has become a moisture availability factor, and the rainfall rate curve is adjusted upward or downward based on the PW value, while the RH factor has been modified, such that a fixed amount of precipitation is evaporated prior to reaching the ground, rather than removing a fraction of the falling precipitation.
- Orographic correction: a Digital Elevation Model of South America at the GOES scale combined with low-level winds produce an orographic correction to the satellite rainfall rate distribution producing enhanced precipitation upstream and less rainfall downstream (Vicente et al, 2001).
- Screening method: This technique assumes that raining pixels are colder than the mean of the surrounding pixels. (Vila, 2003).

Results

Figures 1 shows the scatterplot of 24-hour, spatialy averaged H-E rainfall retrievals and the observed rain gauge data (interpolated) over Cuareim basin. In this case, there is a dry bias of -6.4 mm, and a RMSE is 19.3 mm. The correlation coeficient is 0.50.
When some corrections are made to satellite estimations, using independent raingauge data to adjust the spatial pattern (Vila y Velasco, 2002), the performance of the model shows a large improvement for all statistical parameters (Figure 2). In this case, the bias for light rain (less than

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10 mm/day) is 0.6 mm and RMSE is 2.5 mm, while for moderate to heavy rain (more than 10 mm/day) the values are -2.4 and 12.6 mm for bias and RMSE respectively.

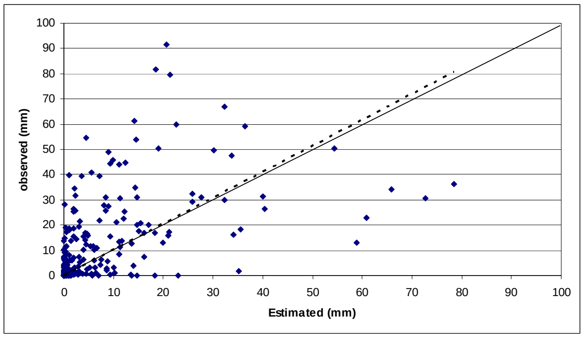

Figure 1: Scatterplot of observed and estimated daily rainfall values (uncorrected)

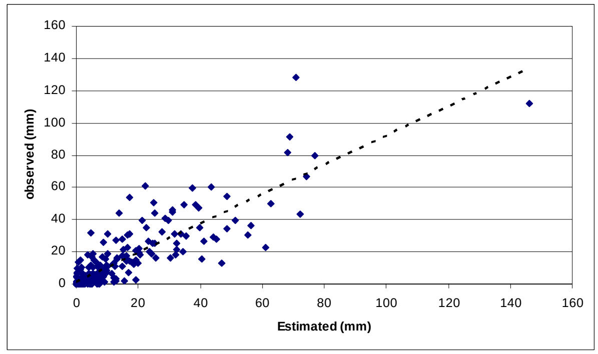

Figure 2: Scatterplot of observed and estimated daily rainfall values (corrected)

Conclusions

In the present study, an statistical validation of H-E and H-E corrected was carried out. The methodology consisted of the reception, in real time, of satellite rainfall retrieval and rain gauge measurements (mainly from the World Weather Watch Network) used as ground truth data to correct the estimations.

The main results are the following:

• The result of the algoriothm show a systematic negative bias around -3.5 mm for all data, with a RMSE around 15 mm. The scarce availability of Southern Hemisphere GOES images (with gaps of up to 90 minutes between images) may be responsible for this situation.

• When an areal retrieval of H-E is corrected with rain gauge measurements, the performance of the model shows a large improvement in all statistical parameters.

A newer version of H-E (Vila & Lima, 2005) has been tested to improve the performance of the algorithm.

References

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